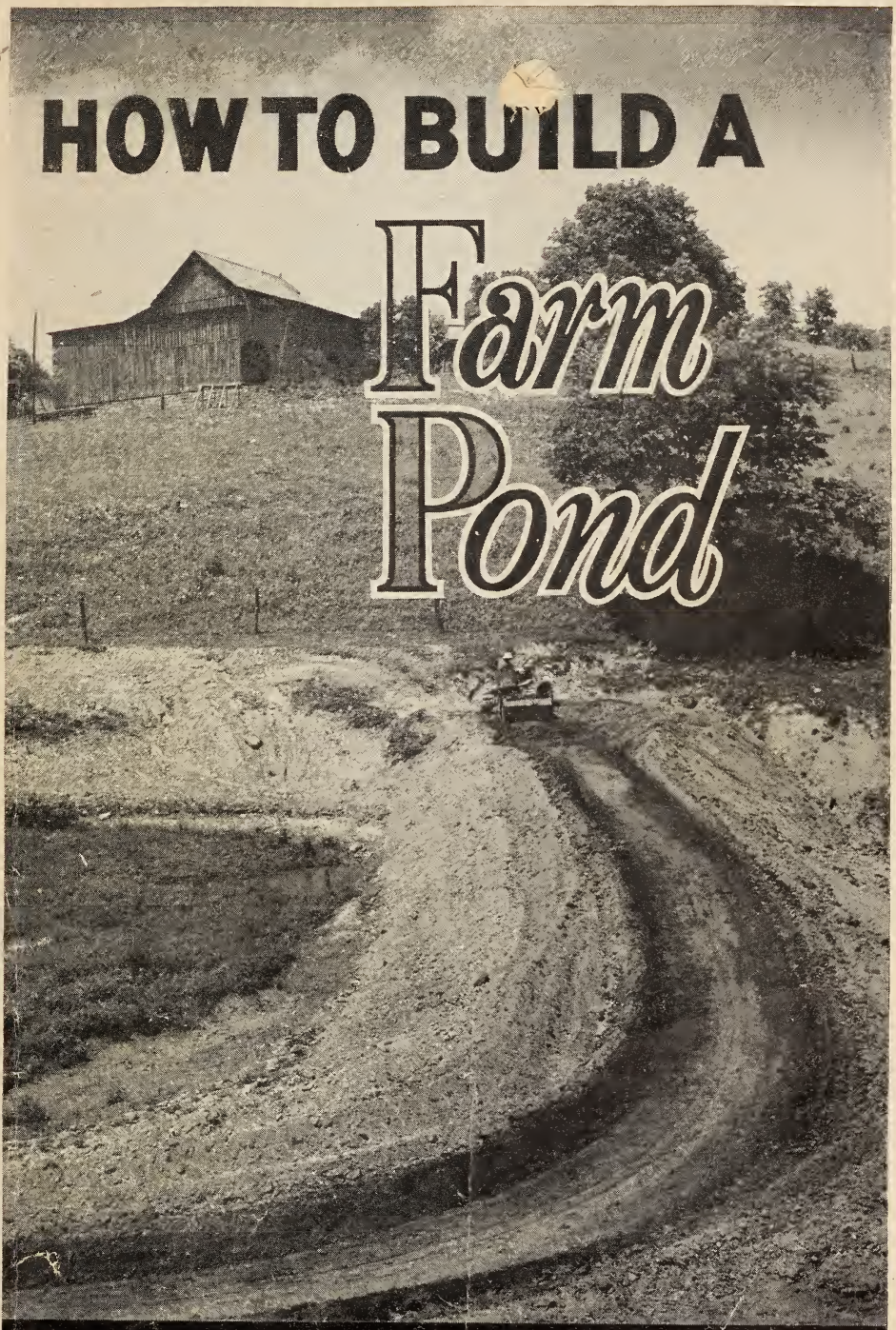
# HOW TO BUILD A Farm Pond



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U. S. DEPARTMENT OF AGRICULTURE

# HOW TO BUILD A FARM POND

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Almost every section of the country frequently has dry spells that damage crops or make it necessary to haul water for livestock. A good farm pond will often help prevent such damage and inconvenience. Furthermore, farm ponds may be valuable in many other ways. They can supply water for fire protection, orchard and garden spray, fish production, recreation, and waterfowl and other wildlife.

Farm ponds should be properly planned and constructed, however, if they are to fill their intended purpose. Certain basic principles must be followed in the design and construction of ponds if you want to get the kind of pond you need with the least expense and labor.

This leaflet explains how you can build and maintain a good farm pond, formed by an earthen dam. The recommendations here are for ponds that have small watersheds—that is, watersheds of less than 30 acres. Ponds or lakes in larger watersheds are not covered here. Neither are those on continuously flowing streams. These should be based on detailed designs of experienced engineers.

## PLANNING THE POND

Most States have laws governing the building of dams that impound water. If you plan to build a pond, you should know about the laws of your State. You may have to get a permit.

In planning a pond, the first thing to do is to decide what size pond you need. This is important, because the pond will be of little use unless it is large enough to furnish you with the amount of water you need at the time you need it. In general, you should make a pond at least 6 feet deep and at least one-fourth acre in surface area. A smaller pond will seldom be satisfactory.

### Investigate the Site

Before you start building a pond you should find out whether you have a suitable site for the kind of pond you want.

The watershed above the pond should be large enough to keep water in the pond during dry periods, yet not so large that it will create flood hazards during heavy rainstorms. Also, it should not be so large as to require a large and expensive outlet structure to carry off excess water safely. Watersheds between 10 and 30 acres are best. The watershed should be covered with grass or ungrazed trees and shrubs. If you cultivate the watershed, you will need to use erosion-control measures to prevent silting. The pond should be free from any source of contamination such as mine waste or sewage from your barn lot or house.

## Test the Soil

Thorough soil tests are needed to make sure your pond will hold water after it is built. Bore or dig test holes to find the kind and depth of the soil at the pond sites you are considering. Many ponds fail because they are built on the wrong kind of land. The best soil is deep to bed rock and has heavy, slowly permeable subsoil that contains lots of clay. Avoid sites with rock outcropping along the bank or with rock or shale ledges near the surface. Also avoid sites having sand, gravel, peat, or marl through which the water might seep. If you build your pond on shallow soil don't borrow dirt for the fill from the pond area. Make your fill from dirt from a borrow pit nearby.

## Make a Survey

You should have a topographic survey of the watershed and the pond site made by a trained technician. From this survey, plans showing the detailed dimensions of the dam and other features should be made. These plans will serve as blueprints for construction of your pond. Figures 1, 2, and 3 illustrate the types of engineering plans you need before you start building a pond.

The technician, who makes the survey, should drive stakes in the ground to outline the pond area and mark all important features of the dam. These stakes will be of great help in constructing the pond, especially if you have to do considerable excavation.

If you are familiar with the use of survey instruments, you may be able to make the survey and design the plans for the pond yourself. It will probably be best to get a technician for this work, however, if one is available. Many ponds have failed because they were not properly designed. If you live in a soil conservation district, you may get a technician to help plan your pond and plan a complete conservation program for your farm, through the supervisors of the district.

## Plan the Spillway

The type and size of the spillway is important. Too small a spillway can easily lead to complete failure of your pond. A combination pipe spillway and side spillway, as illustrated in figure 1, is the most desirable. The normal flow from springs or underground seepage and prolonged flows after storm runoff go through the pipe spillway. The side spillway simply acts as an emergency spillway (fig. 4). Only heavy runoff that cannot be handled by the pipe goes into the side spillway. Thus the side spillway can be kept in good sod cover, since it is dry most of the time.

The bottom of the side spillway must be higher than the top of the pipe spillway. The distance, in height, between the bottom of the side spillway and the inlet of the pipe spillway is shown as "S" in figure 2. This distance ("S") will vary, according to the size of the watershed and the size of the pond. You can determine how much the distance should be in the following manner: Divide the area of the watershed in acres by the surface area of the pond in acres then divide the result by 6. This will give you "S," in feet. For example, if you have a watershed area of 18 acres and the surface area of your pond is to be 2 acres, then "S" will be: $18 \div 2 = 9$ and $9 \div 6 = 1\frac{1}{2}$ feet. This means that the bottom of the side spillway should be $1\frac{1}{2}$ feet higher than the top of the pipe spillway for this particular pond.

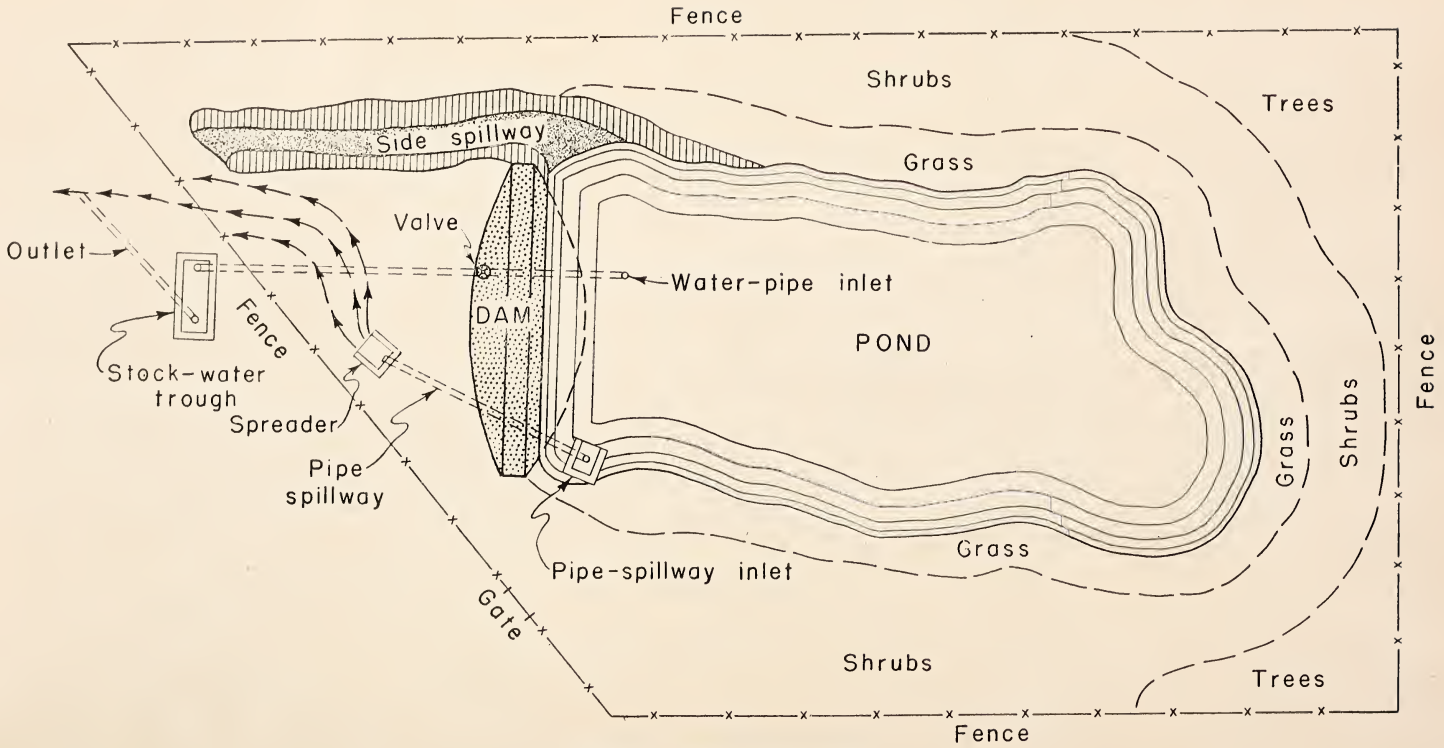


FIGURE 1.—Farm pond lay-out.

The formula given here for figuring the distance "S" has been obtained from the study of many ponds already built.

The distance in height ("S") should not be less than 1 foot or greater than 3 feet. If the calculations produce an "S" greater than 3 feet, you should have an experienced engineer plan a different type of spillway.

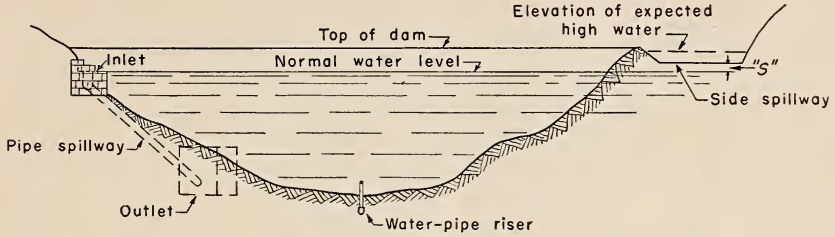


FIGURE 2.—Profile through axis of dam, showing the relative elevations of the side spillway, pipe spillway, and top of dam.

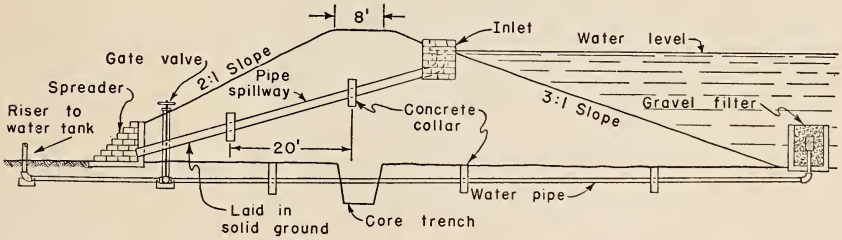


FIGURE 3.—Cross section of fill showing core trench, pipe spillway, water pipe, side slopes, and top width.

## Size of Spillways

By allowing the proper distance ("S") between the pipe spillway and the side spillway, the following sizes for spillways should give satisfactory results:

| *Watershed area* | *Diameter of pipe spillway* *Inches* | *Bottom width of side spillway* *Feet* |
|---|---|---|
| 10 acres | 6 | 8 to 10 |
| 10 to 20 acres | 8 | 10 to 15 |
| 20 to 30 acres | 10 | 15 to 20 |

Increase the bottom width of the side spillway 1 foot for each 2-acre increase in watersheds greater than 10 acres.

## The Pipe Spillway

Your pipe spillway may be either one of two general types. It may have just a catch basin inlet for handling runoff only. Or it may handle runoff and also drain the pond. If you expect to use the pipe spillway to drain your pond, you must provide for a valve inlet near the floor of the pond.

The main inlet to the pipe spillway should have a cross-sectional area at least twice as large as that of the pipe. The inlet should be at least four times as deep as the diameter of the pipe. The inlet may be built of plain

or reinforced concrete, of concrete blocks, or of pipe. Concrete blocks or pipe will be satisfactory for the shallow catch basin type. Reinforced concrete or metal pipe should be used, however, for deep inlets.

Your spillway pipe should be an asphalt-coated corrugated metal pipe, or a concrete, a vitrified-clay, or a cast-iron pipe. If you use concrete or clay pipe, support it on a concrete cradle. There should be a metal or concrete cut-off collar every 10 to 20 feet along the spillway pipe. (Also you should have such collars on the water pipe where it passes through the dam.) Water from a pond tends to seep along the outside surface of any pipe that leads through the dam. Cut-off collars check the flow of this seeping water.

You must protect the outlet end of the spillway pipe and the toe of the earth fill against erosion. Do this by extending the pipe outlet 10 to 15 feet beyond the toe of the fill, or by building a stone or concrete apron at the outlet end.

## BUILDING THE POND

### Making the Earth Fill

The top of your fill should be at least 8 feet wide. It may need to be wider if you use heavy equipment to build the dam. The downstream slope of the fill should be 2:1 (2-foot horizontal for every 1-foot rise). The upstream or water side slope should be 3:1. The fill should be built about 10 to 15 percent higher than the plans specify, to allow for settling.

Clear all stumps, rocks, brush, and debris from the dam site and pond area before you start building the dam. Prepare a foundation for the dam by removing the sod and topsoil to a depth of 6 inches or more to insure a sound base on which to build your fill. You can shift this removed material to the lower toe of the dam.

Your earth dam may require a core trench filled with impervious materials to prevent water seeping under the fill. The depth of the core trench will depend on the kind of soil you have and the underlying material. This information can be obtained from the soil borings. The core trench should go down to a watertight soil and be continuous for the full length of the dam, and extend well into the natural banks on both ends. It should be at least 4 feet wide. You can place the material you excavate from this trench in the lower side of the dam if it is suitable for the fill. Fill the core trench with a moist, impervious clay. Spread the clay in layers of not more than 6 inches and thoroughly pack each layer with a sheep's-foot roller or by repeated trips over it with the construction equipment.

Roughen the area on which the main fill will be built by plowing or disking to provide a good bond between the natural ground and the fill material. Use moist dirt to build the fill. You cannot pack dry soil satisfactorily. The soil should be moist enough to be just barely plastic so that you can roll it out between your thumb and forefinger. If the material is too dry, water should be added. If you can squeeze water out of the soil, it is too wet to spread and compact properly.

Spread the dirt for the fill in layers of 6 to 8 inches. Thoroughly compact each layer either by using a sheep's-foot roller or by systematically running the construction equipment over it before the next layer is placed.

The dam should be started at its widest section and tapered in as the fill builds up. This will help you to thoroughly compact the slopes.

If rain stops your dam-building operations, wait until the surface of the partly built dam is dry before you resume operations. Then, harrow or disk

FIGURE 4.—A completed farm pond. The outlet for the pipe spillway is at the far end of the fill on the left. The side spillway leads around the near end of the fill.

the surface of the partly built dam before you add more dirt to it. This will prevent forming of a seepage channel between the rain-packed surface and the new fill.

If the soil from which your dam is being built is very stony, you should place the stones in the lower third of the fill, tamp them in with clay, and not allow them to accumulate in piles.

## Laying the Water Pipe and Pipe Spillway

The trench for the water supply pipe can be excavated after the key trench is filled, but before the main fill is started. First cuts are usually made with a plow and then the trench is finished by hand. Notches for the cut-off collars are cut in the bottom and sides of the trench. A galvanized water pipe (1½ inches or larger) is laid in the trench. Clay soil is tamped firmly around it until the trench is filled, except for the notches. The backfill should be spread in 6-inch layers to insure thorough compaction. The concrete collars are then poured. The pipe will serve as a drain while your dam is being built. Then a 2- to 3-foot riser of perforated pipe is installed at the upper end of the pipe. This riser should be protected by a screen. The lower end of the pipe is led to a water tank, or elsewhere. A cut-off valve should be installed below the dam. You may also have a float valve in the tank to shut off the water automatically when the tank is full. Figure 3 shows a plan for this installation.

If a pipe spillway is laid in the bottom of the draw to permit draining the pond, the pipe should rest on the bottom or, if there is one, below the core trench. If this is not possible, you must be careful, when backfilling the core trench, to prevent settlement under the pipe. If the spillway pipe is

laid on the side, as shown in figure 1 and figure 3, the core trench will not be a problem.

### Making the Side Spillway

Usually, you will want to make the side spillway while you are building the dam. The material you excavate from the spillway may be used for the fill, if it is suitable. The spillway should be flared at the inlet end. It should lead around the end of the fill and not over the fill (fig. 4). It should empty onto a well-sodded area. You may need a level spreader at the end of the spillway to spread the water as it empties onto the grass.

### Finishing the Pond

After the dam and spillway are completed they should be limed and fertilized, seeded with a good grass mixture, and mulched with manure, straw, or similar materials. To protect the dam, it is important to establish a good cover of grass quickly. Until a good cover has been established in the emergency spillway, you should not allow the pond to fill with water. You may want to sod the dam and spillway to get immediate cover.

You should grade all edges of the pond before it fills with water. The edges should have about a 2:1 slope and the grading should extend about 3 feet below the normal water level. This grading will help to eliminate swampy conditions and undesirable weed growth around the pond.

Build a fence to protect the pond, spillway, and dam from livestock. The fence should enclose a strip of ground 30 to 50 feet wide around the pond. Livestock can do much damage to a fresh fill in a short time.

And you should plant grass, shrubs, or other vegetation around the shore line of the pond. A grass or shrub border around the pond protects it from erosion and silting, helps insure a clean supply of water, and provides a home for desirable wildlife.

## MAINTAINING THE POND

All ponds require management and maintenance. You should inspect your pond often. You should act promptly to correct any threat of damage from silting, wave action, erosion, burrowing animals, livestock, undercutting, overflow, or any other source.

To prevent your pond from filling up with silt and eventually becoming useless, it is essential that you install adequate soil conservation measures on all the land in the drainage area above it.

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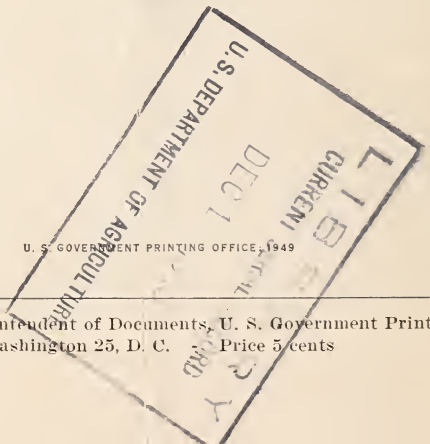


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